

coverage 620 is wider than the coverage 120, the additional message may be broadcast to the vehicles 111, 112, 114 and 115 that fail to receive the SM due to adjustment of the transmission power.

[0102] FIG. 7 illustrates a generating of an SM in a vehicle message broadcasting method in accordance with an embodiment.

[0103] In this example, this operation 310 may include operations 710, 720 and 730.

[0104] Referring to FIG. 7, in operation 710, the processor 220 periodically acquires information about the vehicle 110.

[0105] In operation 720, the processor 220 generates an SM based on the acquired information about the vehicle 110. The processor 220 may change a period of generation of an SM based on a type of the first wireless communication scheme. As only an example, when the first wireless communication scheme is a DSRC scheme, the processor 220 may generate an SM ten times per second while the SM may generate less or more times per second in other schemes.

[0106] Operation 730 is performed in parallel with operation 710. When an event occurs in a vehicle, the processor 220 detects the event in operation 730. When the event is detected, the processor 220 generates an SM by including information about the event in the SM.

[0107] FIG. 8 illustrates a generating of an additional message in accordance with an embodiment.

[0108] The vehicle message broadcasting method of FIG. 3 further includes operation 810, and operation 810 includes operations 812 and 814. For example, operation 810 may be performed prior to operation 350.

[0109] Referring to FIG. 8, when an event occurs relating to a vehicle, the processor 220 detects the event in operation 812.

[0110] In operation 814, the processor 220 generates an additional message including information about the detected event. The additional message also includes information included in the SM broadcast using the first communication scheme.

[0111] FIG. 9 illustrates a determining of whether a transmission power is to be adjusted in a vehicle message broadcasting method in accordance with an embodiment.

[0112] Operation 320 includes operations 910 and 920.

[0113] The vehicle 110 and neighboring vehicles of the vehicle 110 may use the same frequency channel to transmit or broadcast the SM. When a large number of neighboring vehicles are located adjacent to the vehicle 110, the vehicle 110 may compete with the neighboring vehicles to use the frequency channel. When the frequency channel is not acquired, the vehicle 110 may fail to transmit the SM.

[0114] Referring to FIG. 9, in operation 910, the processor 220 calculates a transmission success rate of the SM transmitted using the first wireless communication scheme.

[0115] In operation 920, the processor 220 determines whether to adjust the transmission power of the first wireless communication scheme based on the transmission success rate being less than a threshold success rate. The transmission power may be calculated based on the transmission success rate. For example, the transmission power may be calculated using the below Equation 3, for example.

$$\text{Transmission power} = f_3(\text{Transmission success rate}) \quad \text{Equation 3:}$$

[0116] In Equation 3,  $f_3(x)$  denotes a function to calculate the transmission power. The transmission power may be calculated in a range of a minimum transmission power to a

maximum transmission power. The transmission power may be calculated, for example, in proportion to a value of the transmission success rate. Thus, when the transmission success rate has a higher value, the calculated transmission power may be a higher transmission power when the transmission success rate has a lower value.

[0117] FIG. 10 illustrates determining whether a transmission power is to be adjusted in a vehicle message broadcasting method in accordance with an embodiment.

[0118] Operation 320 includes operations 1010 and 1020.

[0119] Referring to FIG. 10, in operation 1010, the communicator 210 receives external SMs from neighboring vehicles. The external SMs are broadcast from the neighboring vehicles.

[0120] In operation 1020, the processor 220 determines whether to adjust the transmission power of the first wireless communication scheme based on a determined or observed property of the received external SMs. For example, when a number of neighboring vehicles identified by a plurality of external SMs is equal to or greater than a preset threshold, the processor 220 may determine to adjust the transmission power of the first wireless communication scheme.

[0121] FIG. 11 illustrates determining whether a transmission power is to be adjusted in a vehicle message broadcasting method in accordance with an embodiment.

[0122] Operation 1110 is performed prior to operation 320. In operation 1110, the communicator 210 receives a guide from an RSU. The guide may include information about the transmission power of the first wireless communication scheme.

[0123] For example, the EM server 520 of FIG. 5 may acquire information about road and traffic conditions from RSUs, and determine the transmission power of the first wireless communication scheme based on the acquired information. The EM server 520 may transmit a guide to an RSU, and the RSU may broadcast the guide. For example, the RSU may use a DSRC scheme to broadcast the guide.

[0124] Operation 320 includes operation 1120. In operation 1120, the processor 220 determines, based on the guide, whether the transmission power of the first wireless communication scheme is to be adjusted. For example, when a transmission power of the guide is less than a threshold transmission power, the processor 220 may adjust the transmission power of the first wireless communication scheme to the transmission power prescribed by the guide.

[0125] FIG. 12 illustrates a configuration of a vehicle message receiving apparatus 1200 in accordance with an embodiment.

[0126] Referring to FIG. 12, the vehicle message receiving apparatus 1200 (hereinafter, referred to as the "apparatus 1200") includes a communicator 1210, a processor 1220 and a storage 1230.

[0127] The apparatus 1200 may be installed in, for example, the vehicle 110 of FIG. 1. For example, the apparatus 200 of FIG. 2 and the apparatus 1200 may be installed in the same vehicle 110, and may include similar features. That is, the communicator 1210, the processor 1220, and the storage 1230 may have similar features as the communicator 210, the processor 220, and the storage 230 in the apparatus 200, respectively.

[0128] Hereinafter, the communicator 1210, the processor 1220, and the storage 1230 are further described with reference to FIG. 13.